Relation of Neurological Complications of Subarachnoid Block to Some Unseen Dangers of New Techniques

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SUMMARY

Sterilizing solutions that by accident become mixed into the anesthetic agent are probably the etiological factor producing many of the neurological complications following spinal anesthesia.

Use of sterilizing solutions having an intensity of color so great that even one drop in the contents of an ampule will definitely color the anesthetic agent is the criterion of safety.

THE neurological complications of subarachnoid block are discussed widely in the literature. Occasional cases are reported. Many are not reported. To the author's knowledge, during the past two years there have been five patients with such complications referred to neurosurgeons and orthopedic surgeons in the San Francisco Bay Area. Because of the complications reported in the literature and discussed at medical meetings, many surgeons refuse to let their patients have the benefit of spinal anesthesia; some actually help educate their patients against it. Although this is understandable, it is nevertheless regrettable, for many of these neurological complications might have been avoided.

The neurological complications to be considered in this presentation are the more serious ones—those referred to as the cauda equina syndrome—in which the nerves in the lumbosacral distribution of the cord are affected. The results of the complications run the gamut from paresthesia of short duration along one nerve root, incontinence of bladder or bowel, to complete and permanent transverse myelitis. It is pointed out in the literature that the lesion is maximal in the roots that are at the point of injection of the solution. In the case of a complete paraplegia it is obvious that the offending medium is in large quantity or more probably in high concentration, bathing the nerves or cord up to the dermatome level affected. It is not the purpose of this presentation to discuss the exact neurosurgical, pathological, or other aspects of the conditions mentioned. What the etiological factor is and how to eradicate it is the problem at hand. The two following cases are examples of severe complications with a common symptom which is thought to be a very definite clue, one to be looked for in many of these cases.

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CASE REPORTS

CASE 1: Hysterectomy was performed upon a 47-year-old white female patient under spinal anesthesia. The patient stated she felt a marked burning sensation when the anesthetic was given and for a few minutes thereafter. She felt the beginning of the operation but soon became numb.

Postoperatively there was complete anesthesia and paralysis. Two years later the condition became painful and a spastic type of paralysis began. Three years after operation an automatic cord bladder was established.

CASE 2: A white male, aged 45, was given a spinal anesthetic for hemorrhoidectomy.

The patient stated that there was a severe burning sensation in the lower part of his body at the time the anesthetic was given. He stated that he felt most of the short operation but that in the late stages it was painless. The patient was paralyzed thereafter. This was three years ago.

Both patients are permanent paraplegics. Both had pronounced burning sensations when the spinal anesthetic solutions were injected.

In the early days the spinal anesthetic agent was responsible for many neurological complications. Since then much work has been done on concentrations, quantity, and toxicity of the anesthetic agents themselves. The result is that now there are relatively safe drugs and dosages for spinal anesthesia. Today there is practically no excuse for overdosage of the anesthetic drug itself except inexperience or ignorance of or indifference to the abundant literature on the subject. Yet paraplegia still sometimes follows spinal anesthesia. Why? Selective nerve paralysis is produced therapeutically in some conditions by alcohol. The author believes that by accident alcohol or some other antiseptic agent is the actual cause of many cauda equina syndromes following spinal anesthesia. It is known that the patient experiences a pronounced sensation of burning when alcohol is injected in therapeutic block procedures. It will be noted that in the two cases reported in preceding paragraphs the patients had a marked burning sensation upon injection of the spinal anesthetic and for a time thereafter. Could this have been due to alcohol?

Can anyone tell, by observation, the difference between alcohol, formalin, 10 per cent glucose, pontocaine or procaine solution? Can anyone detect at a glance a mixture of the two? The obvious answer is "No"! This is an unseen danger in spinal anesthesia which can be easily eliminated.

During the last few years the pharmaceutical houses have brought out most of our spinal anesthetic agents in solution form. Other solutions in

ampules such as 10 per cent glucose, epinephrine, and ephedrine are now commonly used mixed with the anesthetic agent to produce desired results from spinal anesthesia. These are all colorless solutions. They are labeled at the factory correctly as to their contents. They are presumably sealed by flaming. Between the time they reach the operating floor and the time they are placed on the spinal anesthetic tray it is highly probable that they are made unsafe for intrathecal injection. Small cracks or other microscopic openings due to imperfect sealing are found in even the best ampules. If such an ampule is immersed in a sterilizing solution there may be and usually is some degree of transposition of the two fluids. The possibility is greatest in the case of 10 per cent glucose because of its high specific gravity. Transposition of the two fluids may, however, happen with any of the solutions.

In the majority of hospitals today the ampules which one picks up from the anesthetic tray have been sterilized in a colorless antiseptic solution. In a few hospitals the antiseptic solutions are colored but not adequately. No definite standard or formula has been set up for this. Usually the same process of sterilizing ampules for spinal anesthesia is used as in the case of glass tubes containing suture material. It is amazing that in one of the best and newer textbooks on conduction anesthesia, only a casual reference is made to this subject. To quote, "Ampules of various anesthetic solution are sterilized and stored in covered containers of 70 per cent alcohol dyed with methylene blue. . . . The addition of methylene blue to the solution shows up cracked ampules."[3] To maintain a policy of coloring solutions without definitely standardizing the intensity of the color is, the author believes, more dangerous in the long run than to leave them water-clear. It gives a false sense of security. The author has tested these solutions on many occasions. Frequently no color change could be noted even with equal parts of antiseptic and anesthetic solution mixed together in the ampule. The color must be according to a definite and tested formula. Thus, there is a very simple method of eliminating this unseen danger of using solutions in ampules for spinal anesthesia. A colored antiseptic solution whose ingredients are exactly measured, or some standard solution prepared by a reputable pharmaceutical house which will always be standard, should be chosen. If, after one drop of such a solution is mixed in the contents of the ampule, the color intensity is easily recognized, the sterilizing medium is safe. If no color change is noticed, the sterilizing medium is unsafe.

In one hospital tincture (not solution) of merthiolate is used as the sterilizing medium for all ampules containing solutions to be injected intrathecally. One small drop of this solution from a 25-gauge hypodermic needle will color the contents of the ampule red enough to make it immediately recognized. A red color is preferred to blue since blue is not as well seen in artificial light. Also, in hospitals where blue linen is used in the operating room a bluish contamination of spinal drugs might be overlooked. Red is a standard danger signal.

Another advantage to the use of the undiluted tincture of merthiolate—and this is common to some other acceptable media — is its characteristic of clinging to the outside of the ampule whether wet or dry, thus making the ampule look red. The ampules must be wiped off with a moistened sponge in order that the solution on the inside may be clearly seen. This is an added safety factor as it invariably brings attention to the possibility of transposition of fluids. If there is no colored solution adhering to the ampules, this may warn that some new assistant, not familiar with the problem, has changed the solutions and has probably used alcohol and added just enough merthiolate to color the alcohol. This actually happened at one hospital one time within the last year, and it took a 50 per cent dilution of pontocaine solution with the antiseptic to bring out any color change. Should such a contaminated solution happen to be injected intrathecally, about ¾ cc. of alcohol would be injected.

Measures to correct this real danger throughout the country should be instituted. A special directive could be sent to the superintendents or managers of all hospitals by the American Medical Association or the American Hospital Association, or both, apropos this subject. The pharmaceutical houses are most willing to cooperate. This proposal is being made, not because prominent anesthesiologists throughout the country are unaware of the situation, but because no general action has been taken. This handicaps the surgeon who gives his own spinal anesthetics in the smaller hospitals. He accepts the routine set-up given him and takes for granted that all equipment and drugs have been properly sterilized according to accepted safe techniques. The foregoing discussion shows that there has been no safe and accepted technique outlined for sterilization of spinal ampules.

It is proposed as a safe procedure, when ampules are sterilized in antiseptic solutions, that any antiseptic medium used for sterilization of ampules to be introduced intrathecally be a standard product. If the solution is prepared by the hospital, it should be prepared and colored according to formula. Such solutions should be stored in containers labeled, *"This antiseptic is safe for sterilization of ampules used in spinal anesthesia."*

It is proposed that the criteria for the standardization of any of these antiseptic solutions as concerns the intensity of the color be that:

1. One drop of the colored antiseptic solution, when mixed with the contents of any ampule, gives a definite, intense, and lasting color.

2. The antiseptic solution should adhere to the outside of the ampules, whether wet or dry, after they are removed from the sterilizing container.

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